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## *The* HOME PRODUCTION OF ONION SEED AND SETS

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**M**OST of the onion seed used in this country is produced by special growers. However, by growing his own seed the onion grower can secure strains better adapted to his particular conditions than by using seed bought on the general market. The grower can select a few bushels of mother bulbs from his entire crop, thus enabling him to save seed from choice specimens, while the commercial seed grower uses almost the entire crop for seed production.

The mother bulbs must be carefully stored so they will go through the winter without deterioration. Unless the grower has suitable storage it is best to obtain seed from some one who has all the necessary facilities.

Some sections of the country are not well adapted to the growing of onion seed, owing to soil and climatic conditions. In these sections it is best to buy the seed from reputable growers.

The production of onion sets is not so difficult as the production of seed, as sets are grown in very much the same way as onions for market except that the seed is sown more thickly.

This bulletin gives directions for the growing of both seed and sets, with special reference to the market gardener and truck farmer rather than the seed grower.

# THE HOME PRODUCTION OF ONION SEED AND SETS<sup>1</sup>

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## CONTENTS

	Page		Page
Introduction.....	1	Production of onion sets.....	8
Production of onion seed.....	2	Climate and soils adapted to onion-set growing.....	8
Selection and care of bulbs for seed.....	2	Preparation of the soil.....	9
Care of bulbs during winter.....	3	Fertilizers.....	9
Soils adapted to the growing of seed.....	3	Sowing the seed.....	9
Preparation of the soil and planting.....	4	Distances to plant and quantity of seed required.....	10
Cultivation.....	4	Cultivation.....	11
Time and manner of gathering the seed.....	5	Harvesting and curing.....	11
Curing the seed heads.....	5	Storing onion sets.....	15
Threshing and cleaning the seed.....	6	Sizes and kinds of onion sets.....	16
Yield of seed to an acre.....	6	Varieties of onions used for sets.....	17
Production of seed for onion-set growing.....	7		
Care of onion seed.....	8		

## INTRODUCTION

Many of the leading onion growers of the Northern States are raising their own supplies of seed, and by so doing they procure a better grade than is obtainable in the general market. During the early history of onion-seed growing in this country the crop was practically all produced in small plantings. Later, the production of seed fell into the hands of a few large, speculative growers. During recent years there has been a tendency to return to former conditions.

Formerly the supply of onion seed came from farmers who selected seed bulbs of a uniform type year after year and in so doing established a definite strain; these bulbs were chosen from the entire crop of marketable onions, which permitted the selection of enough bulbs of the type desired for seed. In so doing the farmers were practicing selection, all bulbs not conforming to the desired type being discarded. In commercial onion-seed growing, where the bulbs are grown exclusively for seed purposes, it would not be profitable to discard all those that do not conform to the desired type.

It is customary for growers to select very carefully the few mother bulbs necessary to produce stock seed from which to grow their commercial crop of seed. In cases where commercial seed growers are short of bulbs for seed purposes, they frequently go into the market and purchase the best obtainable to make up the deficiency. Where a farmer is producing 3,000 to 4,000 bushels of onions for the market

<sup>1</sup> For the culture of onions for the general market, see Farmers' Bulletin No. 354, Onion Culture, which will be sent free on application to the United States Department of Agriculture.

from pedigree seed, it is a comparatively easy matter for him to select from that quantity 200 to 300 bushels of extra fine bulbs of the type desired for seed. Onion seed produced in this manner from selected bulbs and costing \$1.50 a pound will be cheaper in the end than seed at 40 cents a pound that has come from a miscellaneous lot of bulbs taken as they run without selection.

Unfortunately, the home production of onion seed is now more or less dependent upon the market price of onions the previous season. Many growers plant for seed only when they have failed to sell their crop, thus giving uncertainty and irregularity to the enterprise. There are a few farmers who plant a fairly uniform quantity of bulbs for seed each year and who are making a decided success of the work.

Certain growers are better equipped than others for the growing and handling of the seed and thus are in position to supply seed for the entire community. It has been found that carefully grown seed planted in the same general locality in which it is produced will give better results than seed brought from a distance; this is especially true in northern localities, where the season of growth is short, as southern-grown seed requires a longer season for its maturity.

The production of onion sets has been confined to a few localities. Sets may be produced under a reasonably wide range of conditions, but in order to be successful it is essential that the grower should fully understand the principles and methods involved. The production of onion seed and sets is an important phase of the general onion industry, but owing to its more local nature it is treated separately.

#### PRODUCTION OF ONION SEED

#### SELECTION AND CARE OF BULBS FOR SEED

The bulbs, or "mother bulbs," as they are commonly called, for the production of onion seed should be grown in the same manner as those intended for marketing, except that more care should be taken throughout. Some seed growers prefer to use 6 pounds of seed to an acre for the production of seed bulbs instead of 4 pounds, as ordinarily used in growing for market, in order that the bulbs may crowd and not become too large. The planting, culture, and harvesting of the bulbs are practically the same as for first-class marketable stock.

Onion-seed growing is a 2-year process and two crops are constantly to be cared for. After growing the bulbs the first summer they must be stored over winter and replanted the following spring for the production of seed. Meantime the crop for the next year's planting must be coming on in order to have a crop of seed every year.

Onion seed can not be grown profitably in all parts of the country, for various reasons. Proper soil conditions are essential; also a climate that is free from extremes of temperature and rainfall. Certain localities in the Northeastern States near the ocean, around the Great Lakes, and on the Pacific coast are especially adapted to the production of onion seed.

The first requisite for the growing of the best seed is a clear-cut ideal of the exact shape, form, color, and general characteristics sought in the variety being grown. The second requisite is the growing of seeds from bulbs of that exact type for the greatest possible number of generations.

Two selections should be made, the first to include but a small number of the very finest and most ideal bulbs from which to produce the stock seed to be used the following year for the growing of the seed bulbs, and the second to include the bulbs from which to grow the supply of seed for the market. By keeping the very best stock separate and using the product for propagation, the entire strain will be gradually improved. Bulbs a trifle below the ideal market size, or about  $1\frac{1}{2}$  to 2 inches in diameter, are the most profitable for seed production.

#### CARE OF BULBS DURING WINTER

Bulbs that are to be used for seed production should be allowed to become thoroughly ripe in the field. After pulling they should be stored in crates under a roof where they will have plenty of ventilation and be protected from sun and rain. Before freezing weather begins the onions should be graded and removed to a house where both ventilation and temperature can be controlled.

The temperature of the room in which the mother bulbs are stored should be kept as near  $45^{\circ}$  F. as possible. Experimental work shows that storing mother bulbs at temperatures below  $40^{\circ}$  for any considerable period of time greatly reduces the production of seed heads and seeds. If the storage temperature is allowed to go above  $50^{\circ}$  for more than a few days there may be considerable losses from sprouting. The storage room should be well ventilated, since high humidity is conducive to the development of disease.

#### SOILS ADAPTED TO THE GROWING OF SEED

Two types of soil may be used to advantage in growing onion seed. The soil upon which the bulbs are grown from seed should be quite rich and well supplied with organic matter and moisture. Good rich sandy loam is best adapted to the growing of the bulbs. For the production of seed from bulbs a soil that is well drained, fertile, and of a loamy nature is desirable. It is customary to grow the bulbs the first season on rich bottom land and to grow the seed the second season on well-drained upland. Soils containing an abundance of lime, such as are suited to the successful production of wheat, are adapted to onion-seed growing. The soil should be free from weed seeds and in a good state of tilth.

The bulbs for seed growing should not be set in a soil containing large quantities of fresh stable manure or green vegetable matter, but rather in a soil where some cultivated crop, such as corn, has been grown the previous season. Commercial fertilizers containing a small percentage of nitrogen, 6 to 8 per cent of available phosphoric acid, and 6 to 8 per cent of potash can be used to advantage at a rate not exceeding 1,000 pounds to the acre.

## PREPARATION OF THE SOIL AND PLANTING

In preparing the land for setting the bulbs, apply the fertilizer and reduce the soil to a good state of tilth. Then mark off the land in rows about  $2\frac{1}{2}$  to  $3\frac{1}{2}$  feet apart by means of a 1-horse plow, a corn marker, or some tool that will leave a decided furrow in which to set the bulbs. In some sections the rows are placed as close as 2 feet, but this hinders cultivation.

The bulbs should be placed by hand (fig. 1), root downward, from 3 to 6 inches apart, center to center, in the furrow. The usual rule is to set the bulbs so that the distance between them will be about 4 inches.

The quantity of bulbs that may be set on an acre will depend largely upon their size, but may be as high as 250 bushels. Where the seed is to be employed for growing sets and overgrown sets are

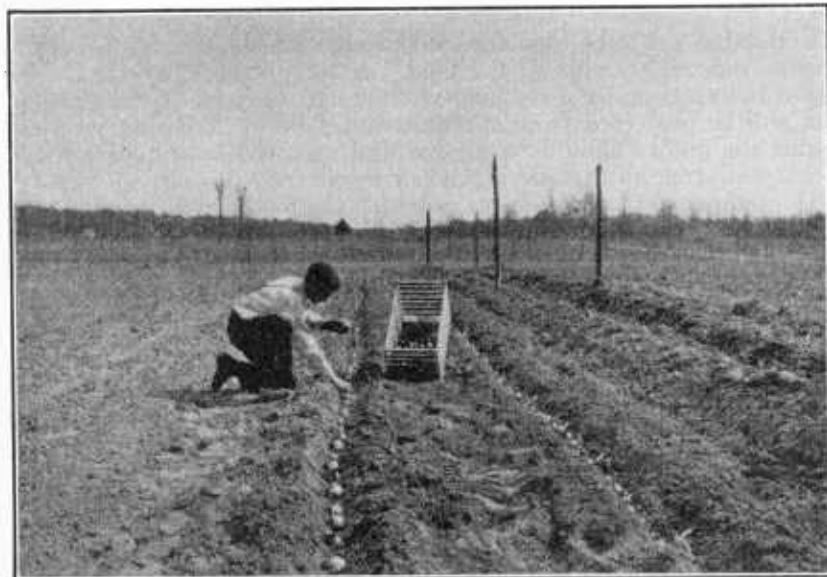


FIGURE 1.—Method of setting out bulbs for seed production

used as mother bulbs, the quantity required may be as low as 50 bushels to the acre.

The bulbs should be placed in the ground sufficiently deep to be entirely below the surface of the soil when covered. As growth proceeds the soil should be drawn around the bulbs to form a support for the seed stalks.

#### CULTIVATION

Shallow cultivation should be given throughout, the object being to keep the land free from weeds and the soil worked toward the plants. Very little handwork will be necessary, except, perhaps, to go through after the seed heads have formed, remove the weeds, and draw the soil around the plants to hold the stalks erect and prevent the seed heads from blowing down and coming in contact with the soil.

## TIME AND MANNER OF GATHERING THE SEED

The proper time to gather the seed is when the inside of the grain has reached the dough stage. Onion seed assumes its black color very early; in fact, before it has passed the watery stage and formed milk in the grain. This change of color is no indication of ripeness and very often deceives the inexperienced grower. The heads should be harvested just before the first-formed seed begins to shatter in handling. Two or three cuttings of the seed should be made, about 20 per cent of the heads being removed at the first cutting.

Figure 2 shows a field of onions a short time before the seed is ripe. In harvesting, the heads are cut one at a time by hand, with a very short piece of the stem attached, and are placed in bags for transportation to the curing sheds.



FIGURE 2.—Field of onion seed a short time before harvesting

## CURING THE SEED HEADS

Any building having a tight floor and in which a free circulation of air can be maintained will serve as a curing place for onion seed. Many growers employ buildings similar to those used for curing tobacco, with the alternate vertical siding boards hinged so that they can be thrown open during good weather. In localities where rains do not occur during the curing period the seed heads are frequently dried on sheets of canvas stretched over frames or spread upon the ground.

For curing the seed in houses, wire-bottomed racks or trays placed one above the other are generally employed. As the seed is stirred from time to time during the curing process considerable of it will

be shattered and will fall upon the tray below or finally upon the floor. The main essentials in the curing of onion seed are to spread the heads very thinly, not over two heads in depth, and to give free ventilation. Even at a depth of 3 inches in the trays it will be necessary to stir them very often, especially during damp weather.

#### THRESHING AND CLEANING THE SEED

The date for gathering the seed depends upon locality and climate, but as a rule this will be about midsummer or not later than August 15. The threshing and cleaning of the seed are often deferred until quite late in the autumn, except where the curing is done in the open air. Where large quantities of seed are produced the threshing is done with special machines, but when grown on a small scale the seed is removed by beating with a flail.

After the seed has been threshed or beaten from the heads there is still considerable danger of its heating or molding if left in too great bulk. The usual practice is to run it through a fanning mill to remove the dust and the small particles of stems, heads, or chaff that are broken up in the threshing. Where the special threshing machines are employed these have a fanning attachment which removes most of the trash.

In California, where a large part of the supply of onion seed is grown, the seed is washed immediately after threshing and is then spread on canvas sheets to dry. In washing, the seed is poured slowly from the bags into a trough of water, the heavy seed settling to the bottom and the lighter seed and the chaff rising to the surface. The seed is then thoroughly stirred so as to permit all of the lighter seed to float. The lighter materials are floated off and the heavier seed lifted out immediately and spread out to dry. It is important that the seed be not allowed to remain in the water more than 30 minutes, and on being taken from the water it should be spread thinly on wire-bottom trays or on canvas to dry. In order that it may become partially dry before nightfall, the seed should never be washed on a damp day or late in the day. On the day following washing, the seed should be frequently stirred with the hands, a board, or a wooden rake. Although the seed may appear to be perfectly clean after drying, there is always some light or shriveled seed present, and it is necessary to put the seed again through the fanning mill once or possibly twice to get out all of the inferior seed.

In sections where the seed can not be dried quickly it is not safe to wash it, but it should be cleaned entirely by means of cleaning machinery. It is not safe to bag the seed and store it until it is thoroughly dry.

#### YIELD OF SEED TO AN ACRE

The quantity of onion seed that can be grown on an acre depends on several conditions. In the first place, this will be determined largely by the size of the bulbs that are planted. In the onion-set districts, where the seed with which to produce the sets is locally grown from overgrown sets, the quantity of seed is generally from 6 to 8 pounds to the bushel of bulbs planted. This seed, however, is not suitable for the production of standard market onions and can be

used only for set growing. In the production of seed from standard mother bulbs the yield is generally from 2 to 3 pounds of seed for every bushel of bulbs planted. The yield has been much higher in many cases, but 2½ pounds is generally considered satisfactory. The yield of seed as a rule will be about 400 pounds to the acre, although as high as 800 or even 1,000 pounds have been secured. White varieties produce a smaller quantity of seed than the brown and yellow varieties.

The price per pound paid for the seed varies according to the quality, variety, and market demands. For first-class high-grade seed from specially selected bulbs of desirable types the growers frequently receive two or three times as much per pound as for the general crops produced from bulbs not specially selected, which must be sold in competition with the great mass of seed produced by large growers.

When the cost of growing the bulbs, together with the preparation of the land, the keeping of the bulbs over winter, the necessity of handling them a large number of times, and the occupying of the land for two seasons are considered, it will be readily seen that there is not a great profit in growing onion seed. However, there are many farmers who each year plant 2 or 3 acres to bulbs for seed and have for sale anywhere from 1,000 to 1,500 pounds of very choice seed. In many cases this represents the money crop of the farm.

The extent to which this enterprise could be conducted with profit is doubtless limited, but the demand for high-grade seed of a distinct type is increasing each year. Anyone contemplating the growing of onion seed should carefully study local conditions and then operate in a small way until the necessary practices are understood.

#### PRODUCTION OF SEED FOR ONION-SET GROWING

Frequently the seed for onion-set growing is produced from bulbs selected from the sets themselves; in other words, the bulbs or mother bulbs are the overgrown sets. Near Louisville, Ky., the onion-set growers select the oversized bulbs and store them over winter. In the spring they send them to farmers in the hill country and have their supply of seed grown on bluegrass land which has not been heavily manured. In this way they are able to keep their onion seed free from disease and to obtain a higher vitality than if the seed were grown on the same land where the bulbs were produced.

Owing to the great quantity of seed employed in set growing, it is desirable to secure it cheaply, and the bulbs selected from the sets, being small, will produce a larger quantity of seed per bushel from mother bulbs than when grown in the usual manner. The stock seed bulbs should, however, be well matured, small necked, uniform in size, and selected according to an ideal shape. Onion seed from undersized bulbs is not so desirable, even for set growing, as that from standard bulbs.

After a crop of onion seed has been gathered it is the usual custom to plow up the bulbs and devote the land to some other crop. If the old bulbs are allowed to remain in the soil through the winter, especially if given slight protection, they will produce a small crop of seed the second season. This practice is not recommended except

under special conditions where the land is not valuable or where it is particularly desirable to obtain an additional quantity of seed from the bulbs.

#### CARE OF ONION SEED

The length of time that onion seed will retain its vitality depends largely upon maturity and climatic conditions. Well-matured seed will always keep better than poorly ripened and inferior seed. Under ordinary conditions onion seed loses its vitality very rapidly after the second year, especially if stored in a damp climate. It will often pay to ship the seed to a dry climate for storage.

#### PRODUCTION OF ONION SETS

##### CLIMATE AND SOILS ADAPTED TO ONION-SET GROWING

The term "set," as applied to the onion, indicates a small, undersized bulb which, when replanted in the ground, will produce a large onion. This method of producing onions is perhaps the oldest and now the most universally employed for the growing of small areas of onions in the garden and where an early crop is desired. The common method of producing sets is to plant a large quantity of seed on a small area of fairly rich land and thus produce a great number of bulbs that are undersized, owing to crowding and lack of plant food. The greater number of these bulbs do not attain sufficient size or maturity to produce seed the following season and are really plants in which the process of growth has been arrested.

In the United States the onion-set industry is largely confined to a few areas. The crop is extensively grown near Louisville, Ky., Chicago, Ill., in the Platte River Valley of Nebraska, in southwest-ern New Jersey, and in southern California. The entire area devoted to this enterprise in these localities is estimated at from 2,500 to 3,000 acres. The yield to the acre varies with the locality, but will average about 300 bushels. The market for onion sets is found throughout the entire country, the greater portion being disposed of in small quantities.

The climatic conditions governing the production of onion sets are practically the same as those for standard onions, although it is not necessary to plant quite so early in the spring. Onion sets can undoubtedly be grown in any part of the Northern States where suitable soil conditions can be obtained. The soil adapted to onion-set culture is as a rule about the same as that required for the grow-ing of large onions, except that the land should not be so rich.

In the Louisville district the soil is a clay loam containing plenty of lime. This soil, by the use of fertilizer, will yield 250 to 350 bushels of mature onions and will produce an equal quantity of sets, but the fertilizer requirements for the latter are not so great. This land is underlain at a depth varying from 18 inches to 10 or 12 feet by limestone and is a natural bluegrass soil, retentive of moisture, and comparatively free from weeds.

In the Chicago area there is a variation in soil texture. In the vicinity of South Chicago the area devoted to onion-set growing was formerly a sewage-disposal farm and is laid off in regular level beds. This soil is of a sandy, loamy nature and is very similar to

river-bottom lands. Northwest of Chicago the soil is a more gravelly loam, although in some places it is of a river-bottom or silty nature.

In southwestern New Jersey the soil is a sandy loam, not unlike the Norfolk sandy loam, although it contains more or less gravel, and in places the clay approaches the surface.

It will be seen that onion sets can be grown on any land that is adapted to general truck crops, the main essential being freedom from weeds and a reasonable high state of tillage.

#### PREPARATION OF THE SOIL

In preparing the land for onion-set growing the work should be performed in practically the same manner as for regular crops of onions. The plowing need be only moderately deep, but the soil must be brought to a smooth, fine surface, suitable for the proper sowing of the seed by means of hand drills. The tools generally employed for this purpose are the plow, disk harrow, roller, smoothing harrow, and sometimes a pull or drag made of scantlings or planks. A harrow of the type shown in Figure 3 is adapted to the final preparation before planting.

On some land onion sets have been grown continuously year after year without any appreciably injurious results. In other localities

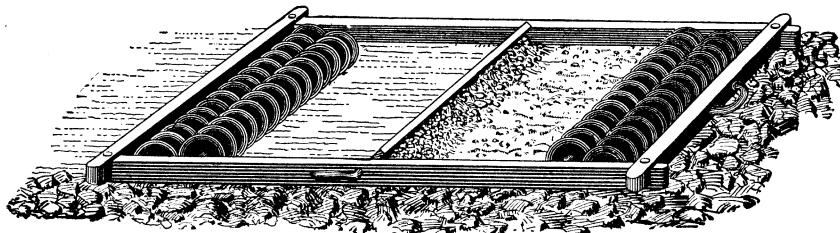


FIGURE 3.—Harrow for leveling soil for planting onion seed

it has been found necessary to adopt a crop-rotation system, and this is advisable wherever the quantity of available land is sufficient. A rotation including corn, potatoes, onion sets, and clover will be found quite satisfactory.

#### FERTILIZERS

In preparing the land for growing onion sets large quantities of barnyard manure should not be applied immediately before planting. If barnyard manure is to be employed, it should be used the previous season on some other crop, in order that it may become fully incorporated with the soil and in a measure subdued.

Commercial fertilizers may be employed profitably in moderate quantities, say 600 to 1,200 pounds to the acre, and should be broadcast at the time of fitting the land. This fertilizer should contain about 4 to 5 per cent of nitrogen, 6 to 8 per cent of available phosphoric acid, and 8 to 10 per cent of potash.

#### SOWING THE SEED

As the essential feature of growing onion sets is the crowding together of the plants in rows, a large quantity of seed is required

to plant an acre. The quantity of seed required varies with the different localities. In the vicinity of Louisville, Ky., from 55 to 60 pounds to the acre are sown; Colorado, 100 pounds; Chicago, 55 to 120 pounds; while in New Jersey as low as 25 pounds to the acre are used.

The drills employed for seeding are, as a rule, the hand seeders usually found upon the market used for sowing the seed of all small truck crops. In some localities, however, special seeders have been designed in order to distribute the seed in a particular manner. (Fig. 4.) These seeders distribute the seed in five little drills about an inch apart, making a broad belt of five rows. Another method is to place a funnel-shaped spreader on the under part of the drill, which scatters the seed over an area of 3 or 4 inches in width.

#### DISTANCES TO PLANT AND QUANTITY OF SEED REQUIRED

The distance between the rows ranges from 7 to 14 inches, but varies with the method of sowing. The larger yields are obtained

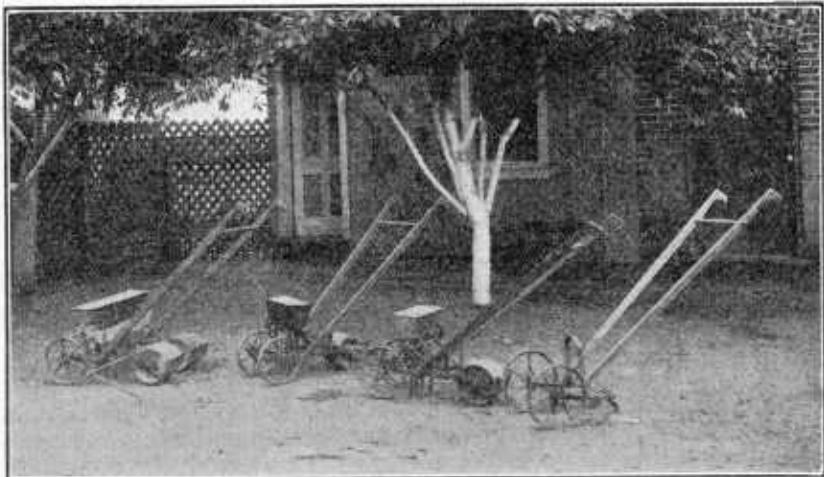


FIGURE 4.—Special tools for planting and cultivating onion sets

by sowing in single drills about 9 inches between the rows and using 65 to 85 pounds of seed to the acre. Most growers endeavor to sow their onion seed as early as the land can be put in first-class condition. Formerly the seeds for sets were not sown until late in the season, but it has been found that larger yields of sets can be obtained and that the sets will ripen better if the seed is sown early.

The New Jersey growers have found it more profitable to grow a sort of mixed crop, including all sizes from sets to marketable onions. A smaller quantity of seed is employed per acre, but, on the other hand, the method of growing is somewhat different, and a larger percentage of overgrown bulbs is secured. Those that are below standard size are sold as "boilers" or "stewers," "picklers," and "sets." By using about 25 pounds of first-class seed to the acre and planting in rows 24 inches apart these growers are enabled to employ horse culture and succeed in growing about 300 bushels of all sizes

to the acre. This method of planting does not greatly decrease the yield and at the same time reduces the cost of cultivation.

#### CULTIVATION

As a rule the onion seed will germinate and the plants appear above ground so that the rows can be followed within six to eight days after planting. It is desirable that the soil should be stirred frequently and that the weeds should never be given an opportunity to gain a foothold. The onion sets should be cultivated at least once every week during their growing period.

The tools employed are for the most part of the wheel-hoe type, of which there are a number of forms. These tools are provided with numerous attachments for cutting close to the plants, for throwing the soil away from the rows, and for leveling and working it back around them. Some of the Chicago growers have adopted a special wheel hoe of their own design, using the front wheel of a bicycle and a pair of lightweight plow handles for the frame, to which the various types of sweeps and shovels are attached. In New Jersey horse tools are employed almost exclusively, the 14 or 15 tooth harrow-type cultivator (fig.

5) being the favorite.

Hand weeding seems to be essential in all localities, although this laborious process can be eliminated to some extent by proper wheel-hoe and horse cultivation. The cost of the cultivation of an acre of onion sets during the season should not exceed \$100, and this may be reduced considerably if the land is in proper condition and the work done at the right time. Hand weeding in most cases will be necessary twice during the growth of the crop. During rainy seasons it is often found impossible to keep certain areas clean, and when the weeds once become well established there is very little hope of saving the crop.

When the sets have attained considerable growth the tops shade the ground and prevent, in a measure, the growth of weeds. After this stage has been reached very little attention will be required. In fact, the stirring of the soil should cease before the sets show any tendency to ripen. Figure 6 will give some idea of the appearance of an onion-set field at the period of its maximum development.

#### HARVESTING AND CURING

The time for harvesting is just when the sets begin to ripen. This generally occurs about July 4 in southern localities and July 20 near Chicago, or 90 to 110 days from the date of sowing the seed. The methods of harvesting are different in the several localities. Near Louisville, Ky., the sets are allowed to become quite ripe before harvesting.

At harvest time the sets are loosened from the soil by means of a cutter attached to a wheel hoe or with broad forks having 10 or 12 tines. They are then pulled by hand, as shown in Figure 7, the tops

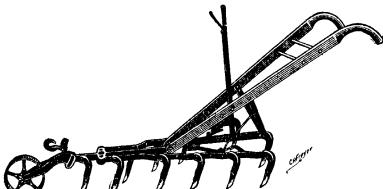


FIGURE 5.—One-horse cultivator of the harrow type



FIGURE 6.—Hand weeding an onion-set field during early summer



FIGURE 7.—Harvesting onion sets near Louisville, Ky.

twisted off by hand, and the bulbs sifted and placed upon trays to dry. These trays are piled one upon another in the field (fig. 8) with a space of 3 or 4 inches between and a temporary roof placed over them. They are allowed to remain upon these trays until quite dry and are again screened and removed to the storehouse.

In some sections the sets are pulled while yet quite green and are stacked in the field in long, narrow ridges (figs. 9 and 10), the bulbs being placed underneath so that the tops will protect them from sunlight and rain. After remaining in these ridges about two weeks, the tops are twisted off and the bulbs placed upon screens to dry. From the screens they are hauled to the warehouse, where the fanning and cleaning take place.

Near Chicago the practice of pulling is very similar to that in the vicinity of Louisville, the tops being twisted off as the sets are removed from the soil. In New Jersey the sets are allowed to become fully ripe before being removed from the soil and are har-

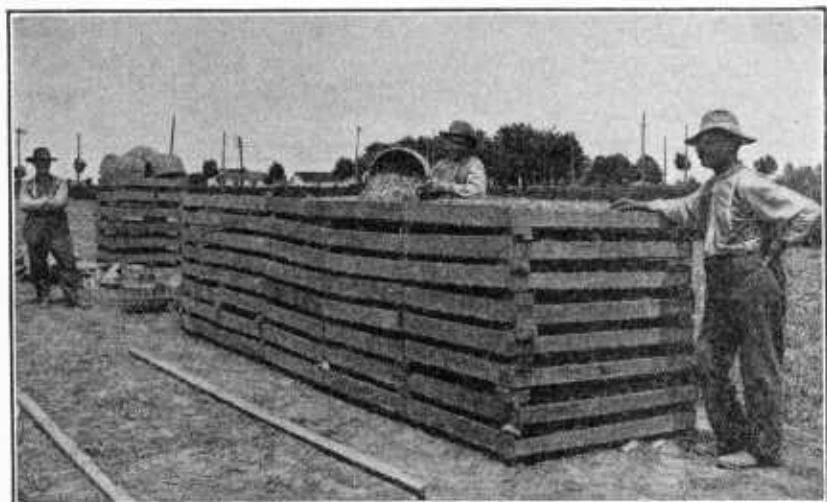


FIGURE 8.—Onion sets drying on trays piled in a field

vested and cured together with the larger bulbs, after which they are separated by fanning and screening.

After pulling, it is essential that the sets be subjected to a drying process; during this process they require plenty of ventilation. This can be most easily secured by spreading the sets on trays, commonly called crates, that are provided with corner pieces extending 4 or 5 inches above the sides of the trays. As a rule these trays are constructed with 3-inch sides, about 5 feet square, with slat or wire bottoms, and hold about 3 bushels of onion sets. When the trays are piled one upon another the corner pieces provide an air space above each tray, thus securing the best possible ventilation. In the absence of corner pieces blocks of wood or broken bricks are employed, as shown in Figure 8. A roof of boards is placed over each stack of trays to protect the onion sets from the sun and rain.

Curing onion sets at a temperature of 100° F. with fan ventilation has proved quite successful in the Chicago district. The trays con-



FIGURE 9.—"Stacking" onion sets to cure in a field

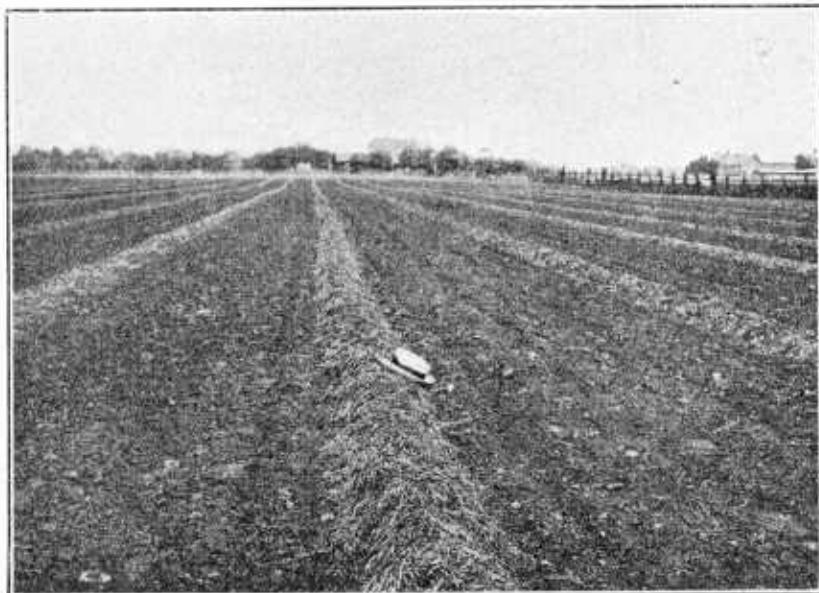


FIGURE 10.—Onion sets curing in "stacks"

taining the onion sets are stacked over a long, narrow trench or tunnel in which there are coils of steam pipe heated from a steam boiler. The stack of trays is then inclosed by setting up sectional board sides which extend a few inches above the stack of trays. The heat is turned on and air is driven through the tunnel by means of a fan. By this method the heated air is driven upward all through the onion sets and they are thoroughly cured in about six hours.

#### STORING ONION SETS

The method of storage is essentially the same in all localities, the tray previously described being most commonly used. (Fig. 11.) When the sets have become sufficiently dry some growers transfer



FIGURE 11.—Onion sets stored on trays in a warehouse

them to the 1-bushel crates, in which they are shipped. Onion sets are stored under conditions similar to those required for large onions, the essentials being plenty of ventilation, dryness, and a comparatively low temperature. Slight freezing will not destroy them, provided they are not disturbed while frozen. However, freezing is always injurious and has a tendency to cause them to sprout earlier in the spring. If a uniform temperature 8 or 10 degrees above freezing can be maintained, it is more satisfactory than too frequent variation.

In Wisconsin onion sets are being successfully stored in a building heated to approximately 70° F. by means of a pipeless furnace placed underneath the onion storage room. The room itself is well insulated but is provided with plenty of windows and ventilators that are kept open during the curing process.

Some growers employ a form of open shed as a temporary storage place for the sets during the autumn months or until cold weather begins. A few growers store their crop until late winter and sell direct to seedsmen and dealers, but the majority turn their sets over to warehousemen for storage and disposal. Throughout the storage period the sets should be handled as little as possible and should be kept spread out thinly, so there will be no chance of heating. Onions in storage are constantly giving off more or less moisture and are liable to become damp and sprout if stored in too great bulk.

In preparing the sets for market they are first passed through a fanning mill, which removes all loose skins, earth, or shriveled bulbs, and then over a screen which removes any bulbs that are too large for the market demands. After this they are shipped in 1-bushel crates, bushel baskets, burlap bags, or barrels.

The crate is perhaps most desirable as a shipping package, as it protects the bulbs and allows free circulation of air. When shipped in bags the sets are liable to become injured, except where they are handled in carload lots. Tight barrels are objectionable unless the sets are thoroughly cured, as there is liability to heat in the center.

#### SIZES AND KINDS OF ONION SETS

The ideal onion set is almost globular in shape and a trifle less than half an inch in diameter. The illustration on the title-page shows a quart of first-class onion sets. The color should be bright and the surface free from smut or spots of any kind.

The term "pickler" is applied to the onion just above sets in size, or, in other words, one-half to three-fourths of an inch in diameter. The term "boiler" or "stewer" is applied to the size next larger than picklers, or from three-fourths of an inch to  $1\frac{1}{4}$  inches in diameter, which are too small for sale as standard onions.

Sets larger than a half inch in diameter have a tendency to shoot the seed when planted.

In addition to the sets grown from seed there are a number of varieties of onions sold as sets that are grown without seed. These may be described as follows:

#### FALL TOP SETS

Fall top sets sometimes are called Egyptian or Catawissa onions. The plants send up seed stalks which often carry a few blossoms and may produce a few viable seeds, but which grow sets in place of blossoms. These bulblets are planted in the fall for early spring bunching. The old plants are also split extensively at the base, so that they are never used for the production of "dry bulbs."

#### SPRING TOP SETS

Spring top sets also produce sets at the top of the blossom stalks, but the sets, which are carried over winter and planted, make large firm dry bulbs, which when planted the following year send up seed stalks and produce a crop of top sets. This type of top set is not offered by dealers as frequently as formerly.

#### MULTIPLIER ONIONS

Multiplier onions make no top sets and rarely produce seeds. There are a number of types. The true multipliers are:

(1) English, yellow multipliers or potato onions are grown to some extent locally from Maryland south. They never send up seed stalks, but large bulbs will produce a group of small bulblets or sets. These, when planted in spring, will produce large firm dry bulbs that are of fair keeping quality.

(2) White multipliers, the bulbs of which rarely send up seed stalks, but from each one a group of bulbs a little larger than pickling onions is harvested. The onion is largely shipped from Louisiana during late winter to the North as bunching onions.

(3) Shallots, not the true shallot, but should be called the Jersey shallot. It sends up seed stems and may make a few seeds, but the main energy of the plant goes into the production of numerous small bulbs at the base. It is extensively used in England and on the Continent as a seasoning onion. Jersey shallots are most often sold in the United States under the name of "multipliers" and may be yellow or red in color.

#### VARIETIES OF ONIONS USED FOR SETS

Seed of almost any variety of onion may be used for the production of sets, but a greater demand exists for the distinctly yellow, white, and red colors. In the trade the sets are recognized by their color rather than by actual varietal names. The demand for the yellow and the white sets is greater than for the red, and those of the globular type are preferred. Onion sets are sometimes grown from left-over seed, in which case a large number of varieties may be included.

Southern-grown onion plants are now supplanting onion sets to a considerable degree, especially for starting early onions grown in home and market gardens. These plants, which are grown mainly in the Gulf Coast States and in southwestern Texas, are crated and shipped in great quantities to northern dealers and gardeners. There appears, however, to be little difference in the cost of the seedling plants as compared with sets, especially for small plantings.

ORGANIZATION OF THE  
UNITED STATES DEPARTMENT OF AGRICULTURE

May 14, 1930

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